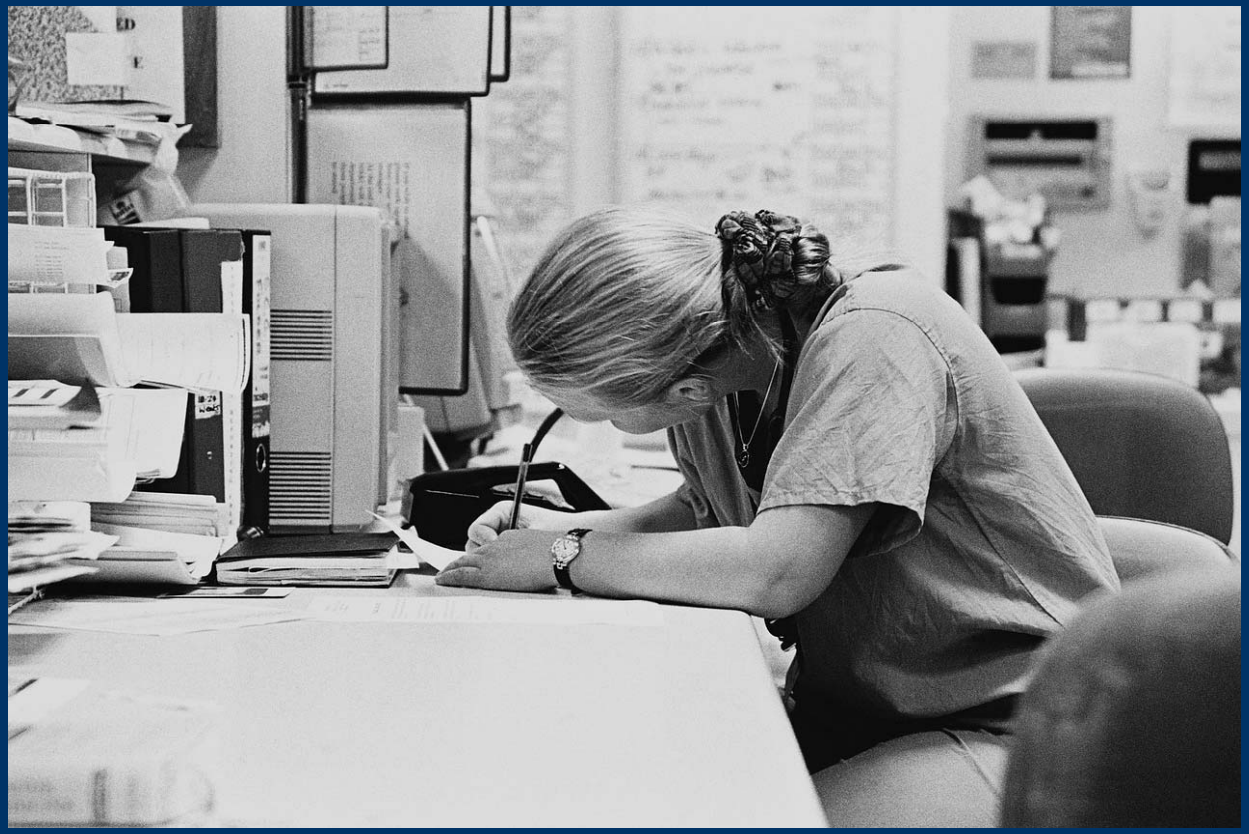
Illicit Discharge Detection and Elimination:

Finding and Identifying Illicit Discharges

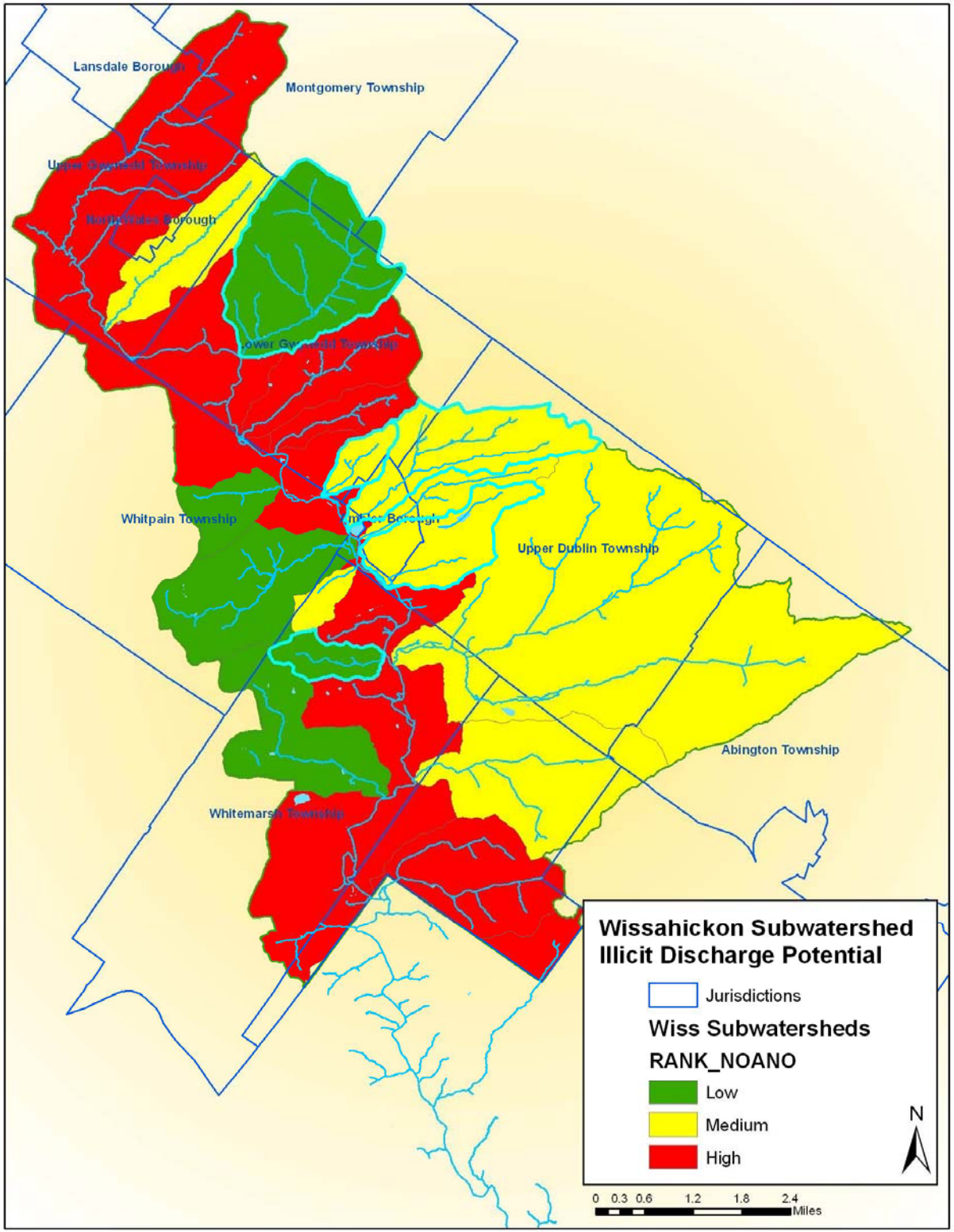
Field work begins…



Areas to prioritize for field work

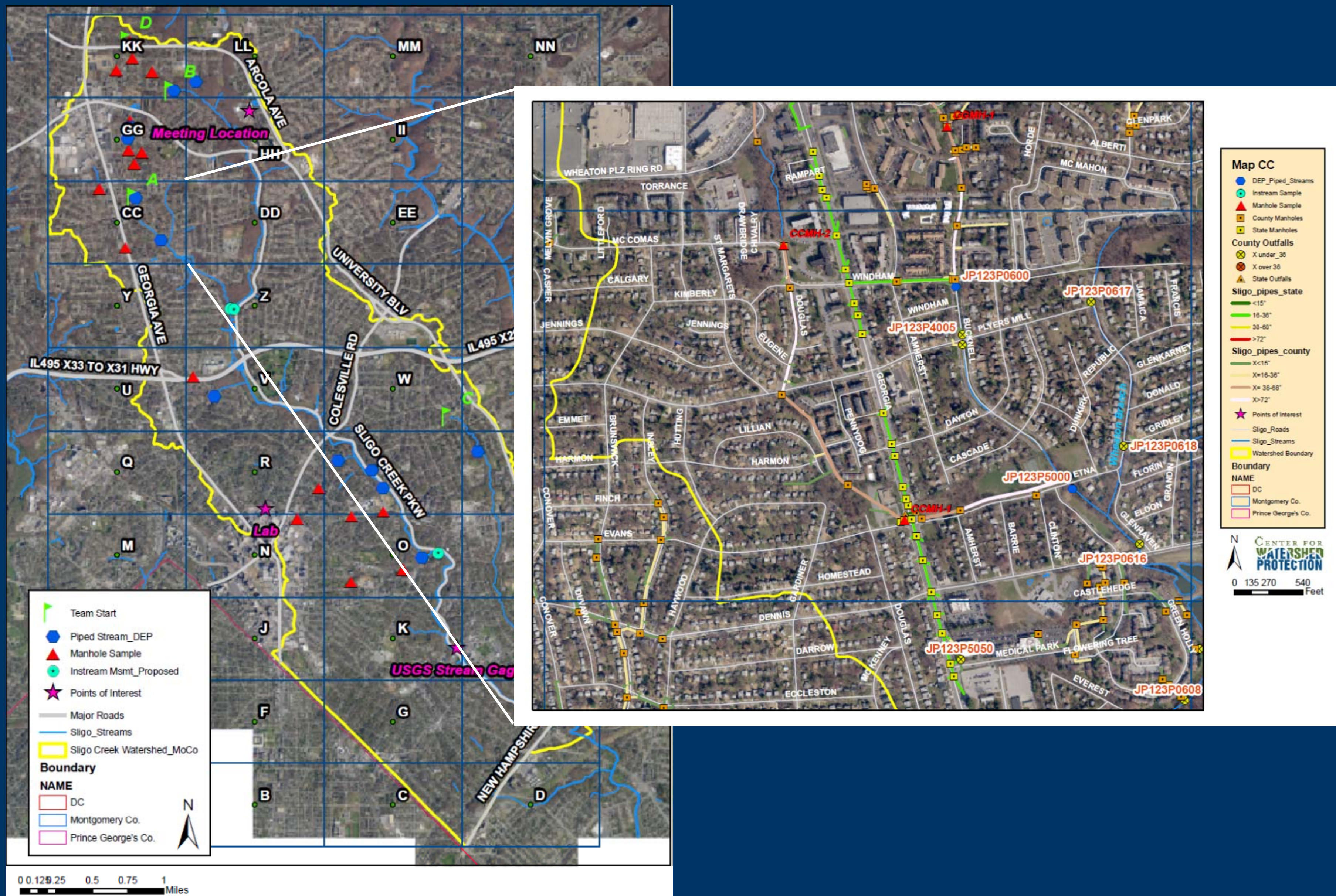
- Past Discharge Complaints
- Poor Dry Weather Water Quality
- Density of Generating Sites
- Density of Industrial NPDES Permits
- Stormwater Outfall Density
- Age of Subwatershed Development
- Former Combined Sewers
- Older Industrial Operations
- Aging or Failing Sewers
- Density of Older Septic Systems
- Past Sewer Conversions

Select the factors that apply most to your community


Lansdale Borough
Montgomery Township
Upper Gwynedd Township
North Wales Borough
Whitpain Township
Upper Dublin Township
Abington Township
Whitemarsh Township
Wissahickon Subwatershed
Illicit Discharge Potential
Jurisdictions
Wiss Subwatersheds
RANK_NOANO
Low
Medium
High
N
0 0.3 0.6 1.2 1.8 2.4
Miles

Preparing for the Field…

Field Maps



Meeting Location
Lab
USGS Stream Gag
GEORGIA AVE
ARCOLA AVE
UNIVERSITY BLV
COLESVILLE RD
SLIGO CREEK PKW
NEW HAMPSHIR
IL495 X33 TO X31 HWY
Team Start
Piped Stream_DEP
Manhole Sample
Instream Msmt_Proposed
Points of Interest
Major Roads
Sligo_Streams
Sligo Creek Watershed_MoCo
Boundary
NAME
DC
Montgomery Co.
Prince George's Co.
N
0 0.125 0.25 0.5 0.75 1
Miles
Map CC
DEP_Piped_Streams
Instream Sample
Manhole Sample
County Manholes
State Manholes
County Outfalls
Sligo_pipes_state
Sligo_pipes_county
Points of Interest
Sligo_Roads
Sligo_Streams
Watershed Boundary
Boundary
NAME
DC
Montgomery Co.
Prince George's Co.
CENTER FOR WATERSHED PROTECTION
0 135 270 540
Feet

Field Supply List

- GPS unit
- Camera
- Measuring tape
- Stopwatch
- Ping pong ball
- Graduated container
- Safety gloves
- Sample bottles (clean/sterile)
- Cooler / ice packs
- First Aid kit
- Pencils / sharpies
- Outfall marker
- Calculator
- Flashlight
- Dipper
- Waders

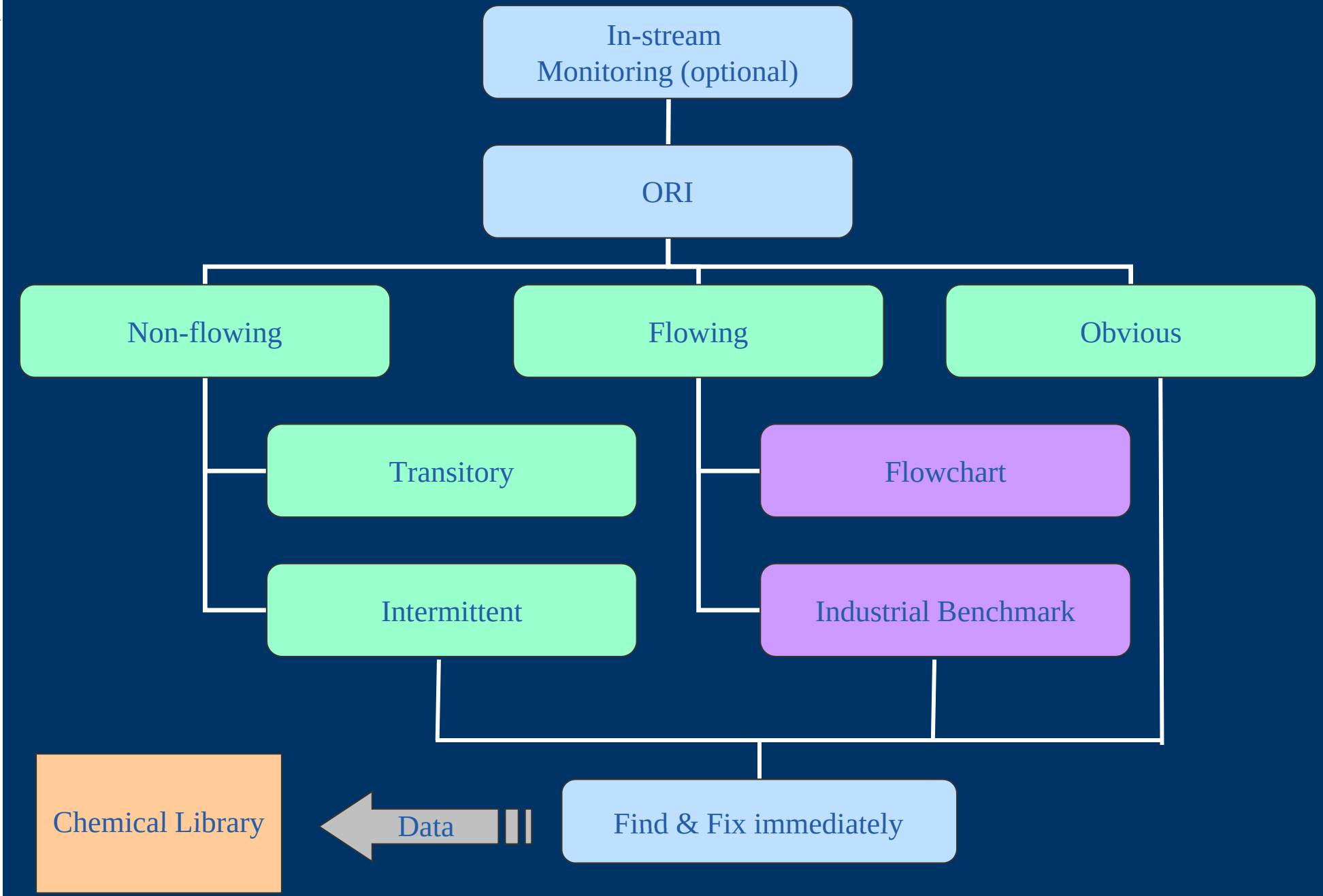
Safety Guidance

Field safety

- Wear waders, with good grip
- Wear rubber gloves when collecting samples
- Hand sanitizer is your best friend
- If working in manholes, wear steel toed boots and use a pick (not your fingers)
- Wear goggles when using hazardous reagents

Lab safety

- Wear latex gloves when processing samples
- Dispose of materials properly, according to MSDS sheets
- Bacteria plates can be soaked in bleach after counting
- Use a hood, if / when necessary
- Wear goggles when using hazardous reagents


In-stream
Monitoring (optional)
ORI
Non-flowing
Flowing
Obvious
Transitory
Flowchart
Intermittent
Industrial Benchmark
Chemical Library
Data
Find & Fix immediately

Field Assessments
The Basics

- Time of year considerations
- Supplies
- Staffing requirements
- Safety considerations

Outfall Reconnaissance Inventory (ORI) Map, Mark & Photograph Outfalls

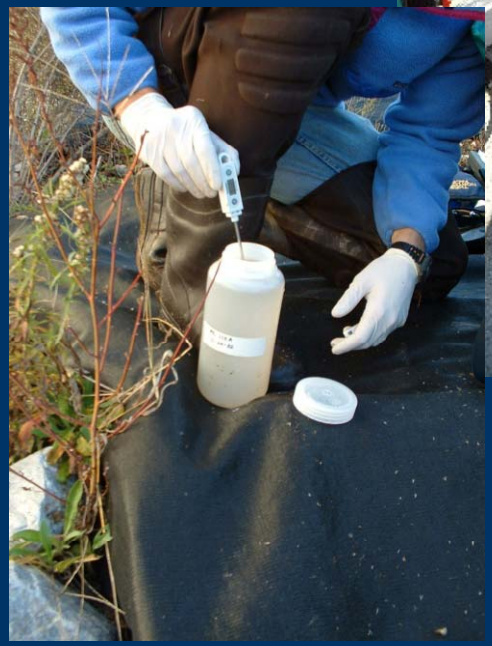
- Assign unique ID to each outfall
- Physically mark each outfall
- Use a GPS unit to record outfall locations
- Take a photograph

Outfall Reconnaissance Inventory (ORI)
Record Basic Characteristics

- Dimensions
- Material
- Whether or not outfall is flowing

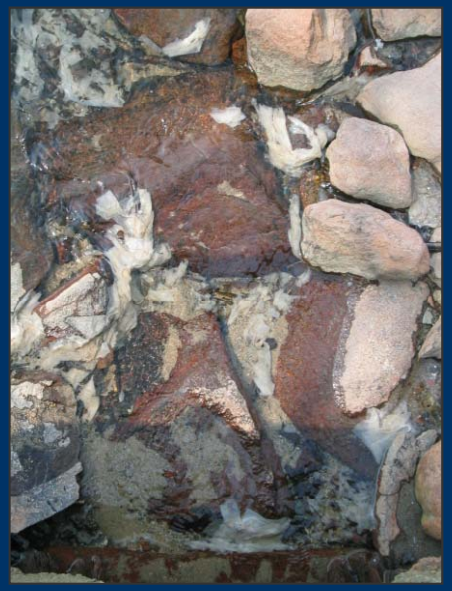
Outfall Reconnaissance Inventory (ORI)
Simple Monitoring at Flowing Outfalls

- Flow
- pH
- Temperature
- Ammonia



Outfall Reconnaissance Inventory (ORI)
Physical Indicators for Flowing Outfalls

- Odor
- Color
- Turbidity
- Floatables



Source: Fort Worth DEM

Outfall Reconnaissance Inventory (ORI)

What to do when obvious illicit discharge encountered?

- STOP the ORI
- Track the source
- Contact appropriate water pollution agency
- Photo document, estimate flow, and collect a sample – if safe

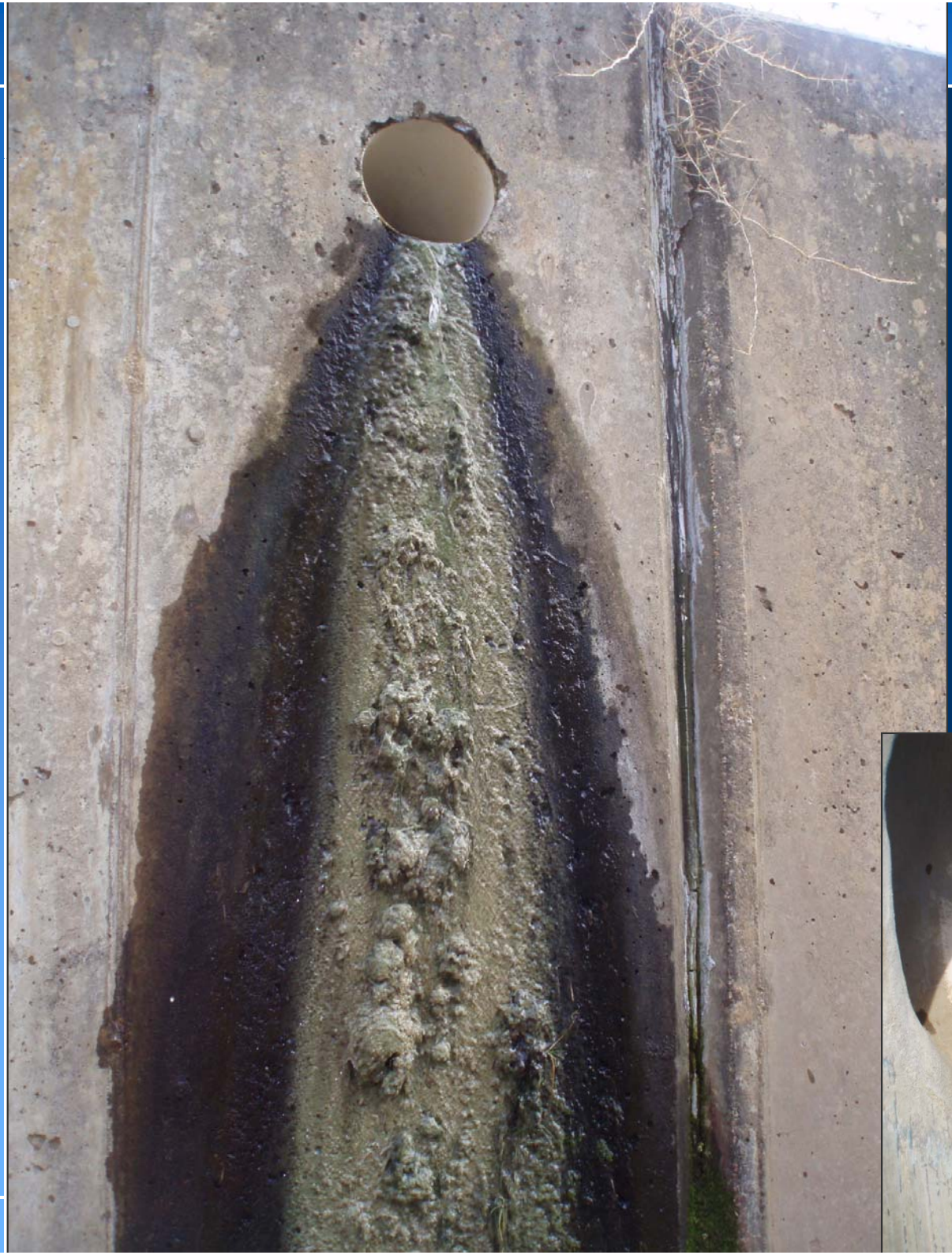
Outfall Reconnaissance Inventory (ORI) Physical indicators at flowing and non-flowing outfalls

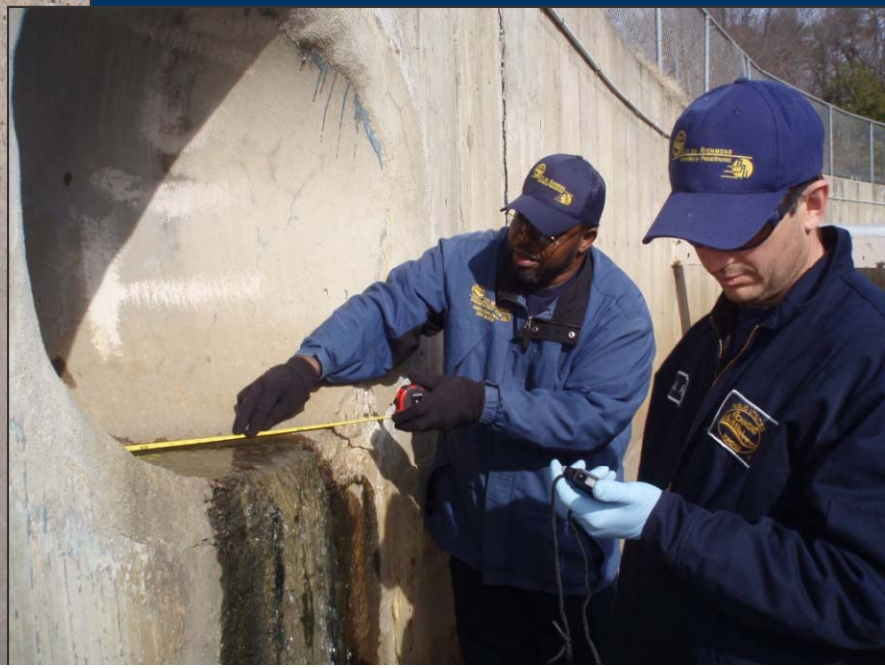
- Outfall Damage
- Deposits/Stains
- Abnormal Vegetation
- Poor Pool Quality
- Pipe Benthic Growth

Quick and Dirty ORI Exercise

(Pardon the pun!)


10. 18





Center for Watershed Protection

The ORI Cannot:

- Find all discharges (can sometimes lead to a “false positive” as well)
- Detect intermittent flows that leave no trace
- Quantify impacts definitively (no direct measure of relative problem)
- Define sources (except for some obvious indicators)

Indicator Monitoring

- More detailed sampling to:
  - ID problem outfalls not apparent from physical indicators alone
  - Test suspect or problem outfalls to confirm if illicit discharge
  - Determine flow type
  - Analyze intermittent discharges

Indicators to Identify Sources of Contamination

Ideal indicator to identify major flow sources has the following characteristics:

- Significant difference in concentrations between possible pollutant sources;
- Small variations in concentrations within each likely pollutant source category;
- Conservative behavior (i.e., no significant concentration change due to physical, chemical or biological processes);
- Ease of measurement with adequate detection limits, good sensitivity and repeatability.

Key Lab Considerations

- Equipment cost
- Staff training
- Number of samples
- Safety
- Disposal

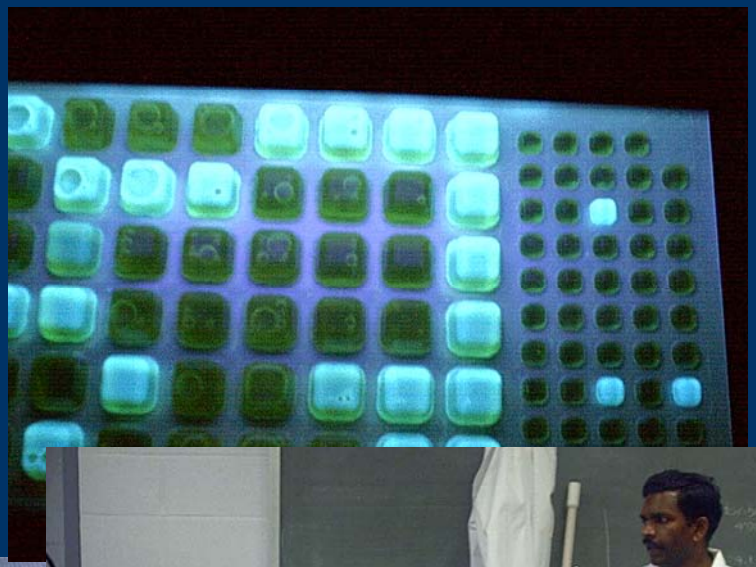
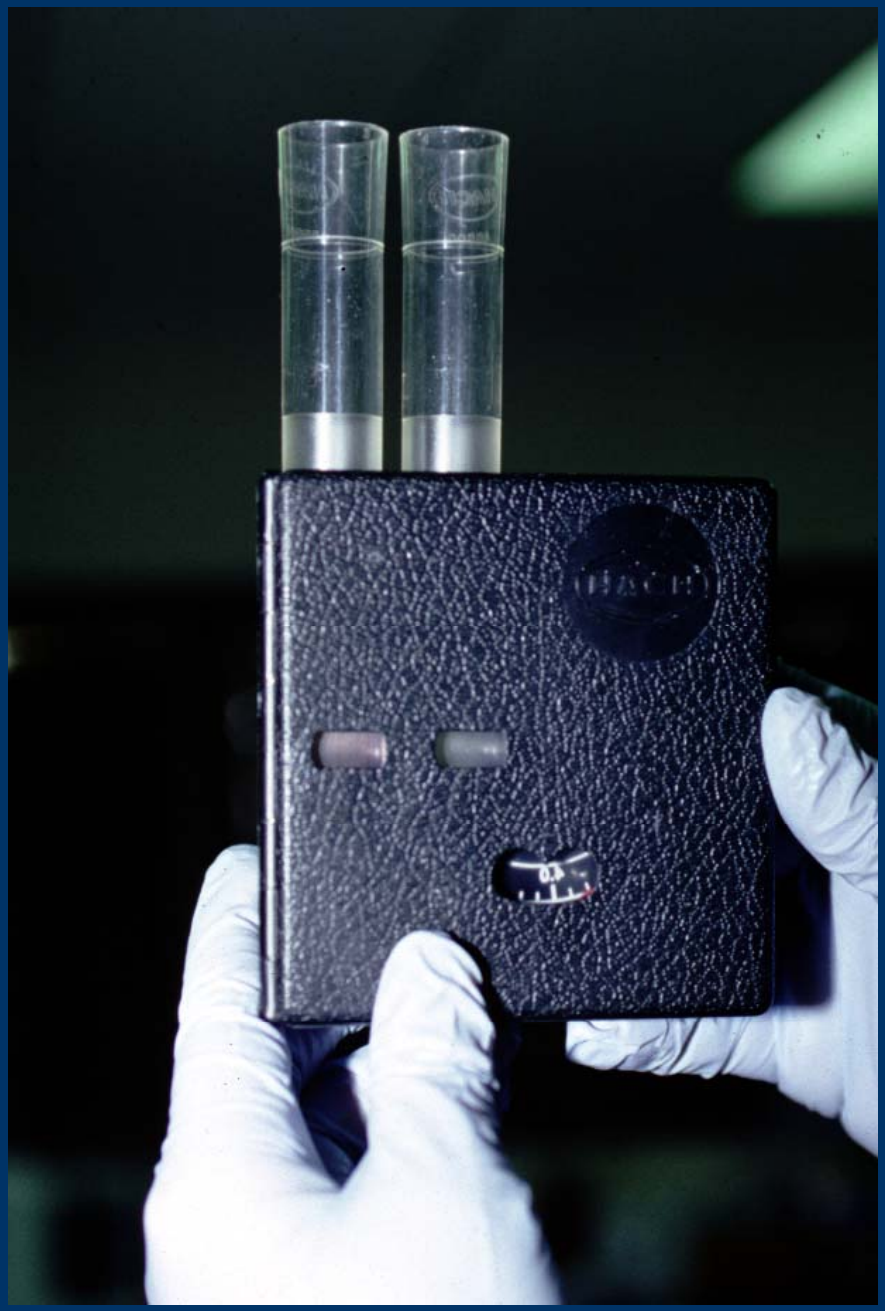


Photo Source: Robert Pitt

Simple and Inexpensive Analytical Methods (can be used in the field, but usually much easier, safer, and more efficient in lab)

- Comparative colorimetric methods (apparent color, detergents after extraction)
- Simple probes (pH, conductivity, ion selective potassium)
- Spectrophotometric (fluoride, ammonia, boron)




CHEMets REFILL
DETERGENTS
K-9400
CHEMets KIT
DETERGENTS
K-9400
ATTENTION

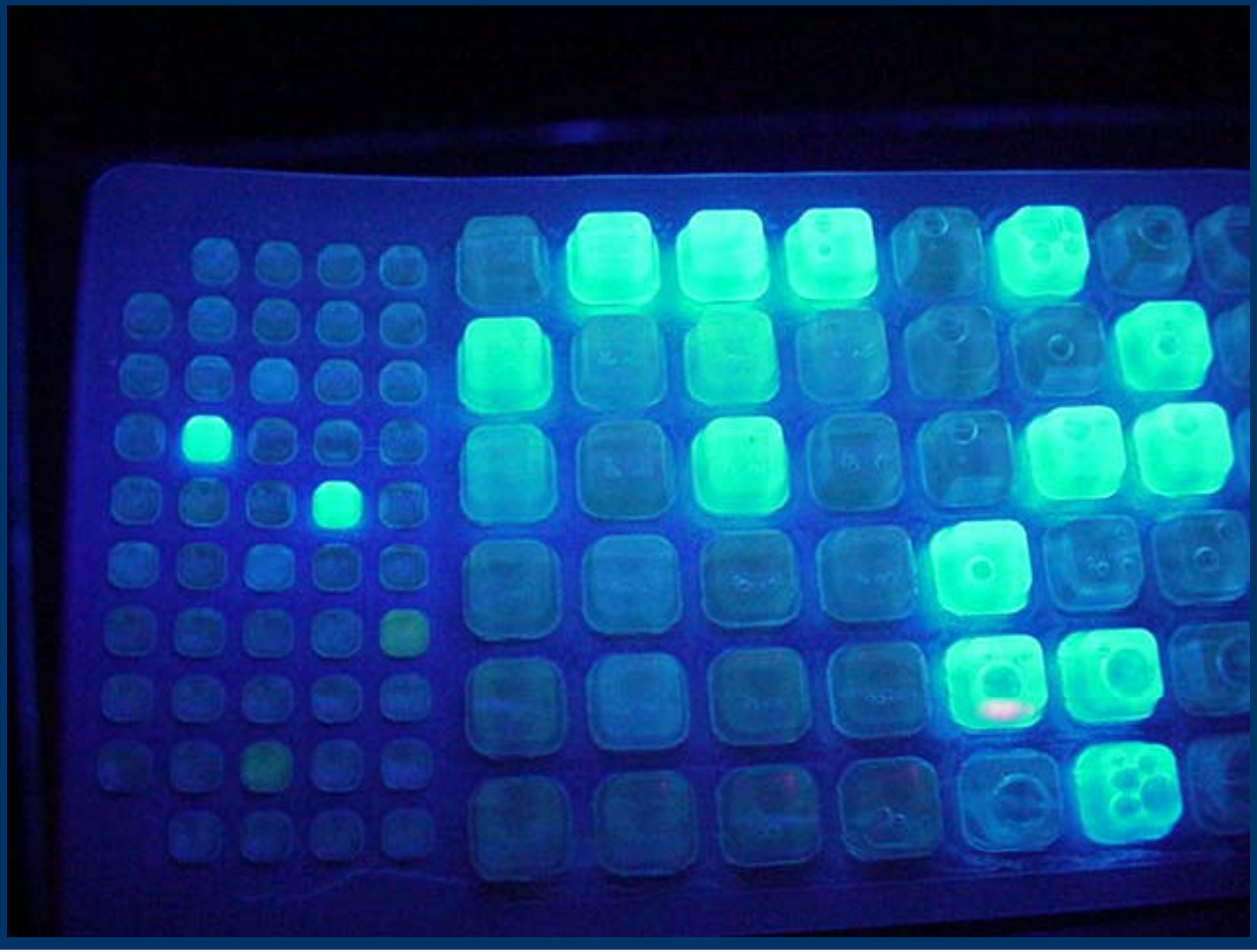

MPARATOR
Catalog No.
C-9400
RK PLAC
Metrics
etergents, PPM
.75


HORIBA
7
ppm


Portable Datalogging Spectrophotometer
0.00
655nm
mg/L NH3-N Salic
HACH DR/2010
%T
ABS
CONC
ZERO
READ
RECALL
STORE
ERASE
CE
PRINT
TIMER
BATT
EXIT
SELECT
PRGM
SHIFT
SETUP
USER
PRGM
ENTER

Bacteria Monitoring

Quantitray Under UV Light



3M Petrifilm Plates

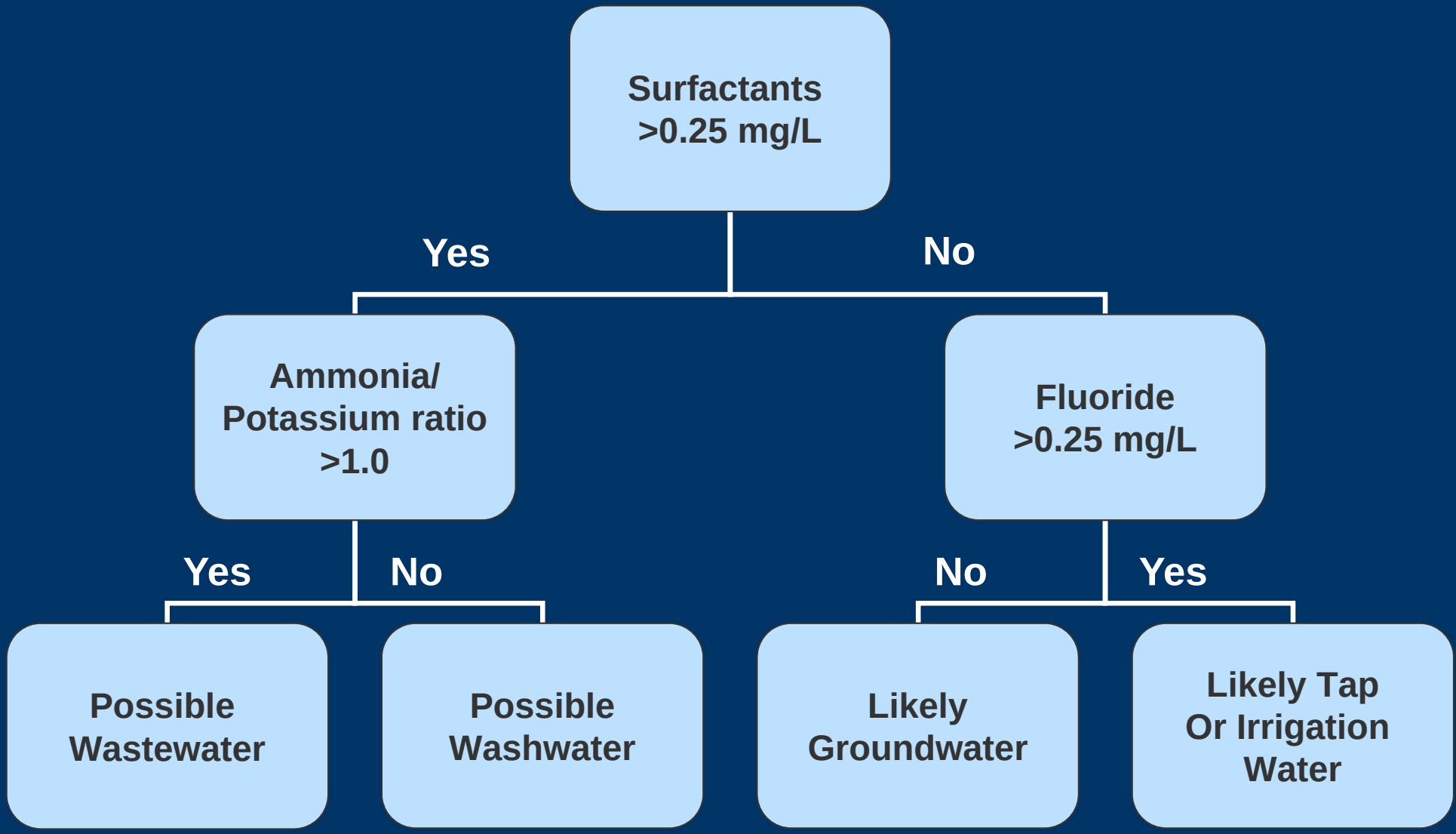
Techniques to Interpret Indicator Data

- Single Parameter Screening
- Flow Chart Method
- Industrial Flow Benchmarks
- Chemical Mass Balance Model

Single Parameter Screening (not necessarily recommended)

- Detergents
  - Best single parameter to detect illicit discharges
  - Analysis conducted in controlled lab setting
- Ammonia
  - Concentrations >1mg/L is positive indicator of sewage
  - Analysis in field using portable spectrophotometer

IDDE Flow Chart (Brown et al, 2004)

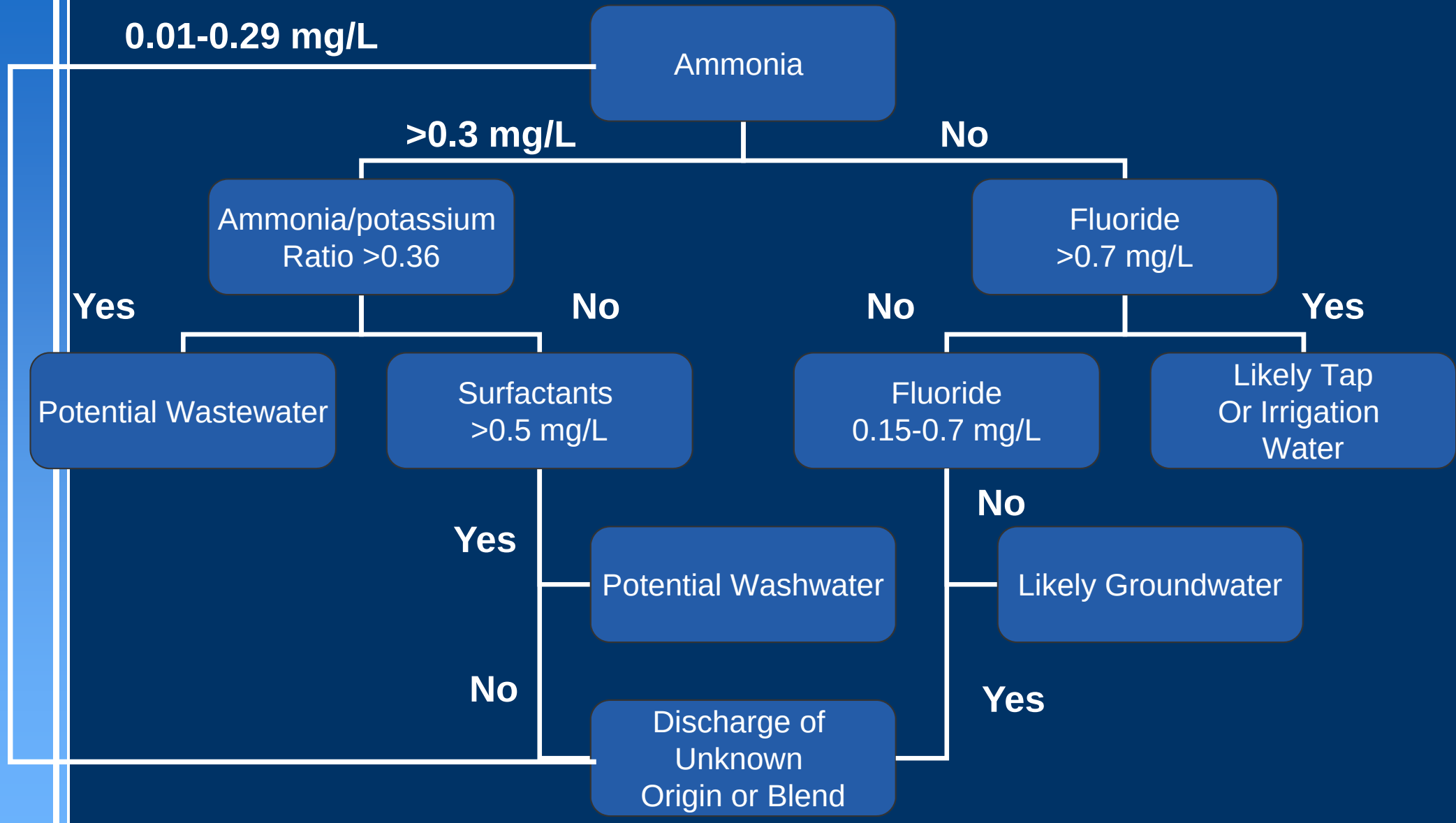


Chemical Fingerprint Library

- Shallow Groundwater
- Spring Water
- Tap water
- Irrigation
- Sewage
- Septic Tank Discharge
- Common Industrial Discharges
- Commercial Car Wash
- Commercial Laundry

Preliminary Tuscaloosa, AL, "Library" File Data

Mean/(COV)	Fluoride (mg/L)	Detergents (mg/L MBAS)	Ammonia (mg/L, as N)	Potassium (mg/L)
Tap water	0.95 (0.03)	0 (0)	0 (0)	1 (0)
Spring water	0.024 (1.3)	0 (0)	0.034 (0.82)	3.4 (0.79)
Car wash water	0.02 (1.4)	80 (1.2)	0.55 (0.27)	6 (0.94)
House laundry water	1.1 (0.18)	960 (0.06)	1.0 (0.15)	2 (0)
Sewage	0.68 (0.07)	11 (0.12)	22 (0.71)	12 (0.19)
Industrial wastewater	0.21 (1.7)	6.0 (0.68)	5.3 (0.73)	49 (0.52)


0.01-0.29 mg/L
Ammonia
>0.3 mg/L
No
Ammonia/potassium Ratio >0.36
Fluoride >0.7 mg/L
Yes
No
No
Yes
Potential Wastewater
Surfactants >0.5 mg/L
Fluoride 0.15-0.7 mg/L
Likely Tap Or Irrigation Water
No
Yes
Potential Washwater
Likely Groundwater
No
Yes
Discharge of Unknown Origin or Blend

Benchmark Concentrations to Identify Industrial Discharges

Benchmark	Concentration	Notes
Ammonia (mg/L)	**≥50**	▸ Existing "Flow Chart" Parameter ▸ Concentrations higher than the benchmark can identify a few industrial discharges
Potassium (mg/L)	**≥ 20**	▸ Existing "Flow Chart" Parameter ▸ Excellent indicator of a broad range of industrial discharges
Color (Units)	**≥ 500**	▸ Supplemental parameter that identifies a few specific industrial discharges
Conductivity (µS/cm)	**≥ 2,000**	▸ Identifies a few industrial discharges ▸ May be useful to distinguish between industrial sources
Hardness (mg/L as $CaCO_3$)	**≤10** **≥ 2,000**	▸ Identifies a few industrial discharges ▸ May be useful to distinguish between industrial sources
pH (Units)	**≤ 5**	▸ Only captures a few industrial discharges ▸ High pH values may also indicate an industrial discharge but residential wash waters can have a high pH as well
Turbidity (NTU)	**≥ 1,000**	▸ Supplemental parameter that identifies a few specific industrial discharges

Take Home Points

- Take some time for the desktop work before heading out into the field
- For single parameter screening, use detergents or ammonia
- Detergents, fluoride, ammonia, and potassium recommended as most useful for identifying contamination of storm drainage systems, as well as tests for *E. coli* or Enterococci
- Begin to document and understand the chemical signatures in Lake County, IL

Q/A

Small Group Exercise